What Is Claimed Is:

1. A wireless local area network (WLAN) device, comprising:

a medium access control layer; and

a physical layer coupled to said medium access control layer, comprising:

a physical medium dependent sublayer, wherein said physical medium dependent sublayer comprises:

a receiver that receives an input radio frequency (RF) signal, wherein said receiver comprises a universal frequency down-conversion (UFD) module, and

a transmitter that transmits an output RF signal; and

a physical layer convergence procedure sublayer coupled to said physical medium dependent sublayer, wherein said physical layer convergence procedure sublayer controls frame exchange between said medium access control layer and said physical layer.

2. The WLAN device of claim 1, wherein said first UFD module receives said input RF signal, wherein said first UFD module down-converts said input RF signal according to a first control signal and outputs a first down-converted signal;

wherein said receiver further comprises:

a second UFD module that receives said input RF signal, wherein said second UFD module down-converts said input RF signal according to a second control signal and outputs a second down-converted signal; and

a subtractor module that subtracts said second down-converted signal from said first down-converted signal and outputs a down-converted demodulated signal.

3. The WLAN device of claim 2, wherein said first control signal comprises a first control pulse and said second control signal comprises a second control pulse, wherein said second control signal

pulse is delayed relative to said first control signal pulse by .5 + n cycles of said input RF signal, wherein n may be any integer greater than or equal to 1.

4. The WLAN device of claim 3, wherein said first UFD module under-samples said input RF signal according to said first control signal, and said second UFD module under-samples said input RF signal according to said second control signal.

5. The WLAN device of claim 4, wherein ~~said~~ first and said second control signals each comprise a train of pulses having ~~pulse widths~~ that are established to improve energy transfer from said input RF signal to said first ~~and~~ said second down-converted signals respectively.

6. The WLAN device of claim 2, wherein said first and said second UFD modules each comprise a switch and a storage element, wherein a first node of said each switch is coupled to a node of the corresponding said each storage element, and a second node of said each switch is coupled to a reference potential.

7. The WLAN device of claim 6, wherein said each storage element comprises a capacitor, wherein said each capacitor corresponding to said first and said second UFD modules reduces a DC offset voltage in said first down-converted signal and said second down-converted signal, wherein said first and said second DC offset voltages are at least due to charge injection effects in said first and said second UFD modules, respectively.

8. The WLAN device of claim 2, wherein said subtractor module comprises a differential amplifier.

9. The WLAN device of claim 1, wherein said first UFD module receives said input RF signal, wherein said first UFD module down-converts said input RF signal according to a first control signal and outputs a first down-converted signal;

wherein said receiver further comprises:

a second UFD module that receives said input RF signal, wherein said second UFD module down-converts said input RF signal according to a second control signal and outputs a second down-converted signal;

a first subtractor module that subtracts said second down-converted signal from said first down-converted signal and outputs an I-phase demodulated signal;

a third UFD module that receives said input RF signal, wherein said third UFD module down-converts said input RF signal according to a third control signal and outputs a third down-converted signal;

a fourth UFD module that receives said input RF signal, wherein said fourth UFD module down-converts said input RF signal according to a fourth control signal and outputs a fourth down-converted signal; and

a second subtractor module that subtracts said fourth down-converted signal from said third down-converted signal and outputs a Q-phase demodulated signal.

10. The WLAN device of claim 9, wherein said first subtractor and said second subtractor each comprise a differential amplifier.

11. The WLAN device of claim 9, further comprising a low-noise amplifier that amplifies said input RF signal.

12. The WLAN device of claim 9, wherein a control signal pulse of said second control signal occurs 1.5 cycles of a frequency of said input RF signal after the occurrence of a control signal pulse of said first control signal;

wherein a control signal pulse of said fourth control signal occurs 1.5 cycles of said frequency of said input RF signal after the occurrence of a control signal pulse of said fourth control signal; and

wherein said third control signal pulse occurs .75 cycles of said frequency of said input RF signal after the occurrence of said first control signal pulse.

13. The WLAN device of claim 12, wherein a re-radiated signal comprises attenuated components of said first, second, third, and fourth control signal pulses to form a cumulative frequency, wherein a ratio of said cumulative frequency of said re-radiated signal to said frequency of said input RF signal is substantially equal to 4:3.

14. The WLAN device of claim 9, wherein said first control signal comprises a first control signal pulse, said second control signal comprises a second control signal pulse, said third control signal comprises a third control signal pulse, and said fourth control signal comprises a fourth control signal pulse;

wherein a potentially re-radiated signal comprises attenuated components of said first, second, third, and fourth control signal pulses to form a cumulative frequency; and

wherein said cumulative frequency of said potentially re-radiated signal is chosen to be greater than a frequency of said input RF signal.

15. The WLAN device of claim 9, wherein a first DC offset voltage in said first down-converted signal due to said first UFD module and a second DC offset voltage in said second down-converted signal due to said second UFD module substantially cancel from said I-phase demodulated signal in said first subtractor; and

wherein a third DC offset voltage in said third down-converted signal due to said third UFD module and a fourth DC offset voltage in said fourth down-converted signal due to said fourth UFD module substantially cancel from said Q-phase demodulated signal in said second subtractor.

16. The WLAN device of claim 9, wherein said first UFD module under-samples said input RF signal according to said first control signal, said second UFD module under-samples said input RF signal according to said second control signal, said third UFD module under-samples said input RF signal according to said third control signal, and said fourth UFD module under-samples said input RF signal according to said fourth control signal.

17. The WLAN device of claim 16, wherein said first, said second, said third, and said fourth control signals each comprise a train of pulses having pulse widths that are established to improve energy transfer from said input RF signal to said first, said second, said third, and said fourth down-converted signals respectively.

18. The WLAN device of claim 9, wherein said first, said second, said third, and said fourth UFD modules each comprise a switch and a storage element, wherein a first node of said each switch is coupled to a node of the corresponding said each storage element, and a second node of said each switch is coupled to a reference potential.

19. The WLAN device of claim 9, wherein said each storage element comprises a capacitor.

20. The WLAN device of claim 19, wherein said each capacitor corresponding to said first, said second, said third, and said fourth UFD modules reduces a DC offset voltage in said first down-converted signal, said second down-converted signal, said third down-converted signal, and said fourth down-converted signal at least due to charge injection effects in said first, said second, said third, and said fourth UFD modules, respectively.

21. The WLAN device of claim 9, further comprising a control signal generator that outputs said first, said second, said third, and said fourth control signal.

SUB A1

22. The WLAN device of claim 1, wherein said transmitter receives an information signal, wherein said information signal comprises an I baseband signal and a Q baseband signal, wherein said transmitter comprises:

(1) a first modulator that receives said I baseband signal and outputs a modulated I phase signal;

(2) a second modulator that receives said Q baseband signal and outputs a modulated Q phase signal;

(3) first differential sampling means for sampling said modulated I phase signal according to a first control signal and a second control signal, to generate an I harmonically rich signal, wherein said second control signal is phase shifted relative to said first control signal;

(4) second differential sampling means for sampling said modulated Q phase signal according to said first control signal and said second control signal, to generate a Q harmonically rich signal;

(5) means for combining said I harmonically rich signal and said Q harmonically rich signal, to generate an I/Q harmonically rich signal, said I/Q harmonically rich signal having multiple harmonic images that contain amplitude and frequency information for reconstruction of the I and Q phase signals;

wherein said first and second control signals have a period of T_S so that said harmonic images repeat at multiples of $1/T_S$;

wherein said first and second control signal comprise pulses having an associated pulse width T_A that operates to improve energy transfer to a desired harmonic image in said corresponding I and Q harmonically rich signals; and

wherein said output RF signal comprises said I/Q harmonically rich signal.

23. The system of claim 22, wherein said T_A is approximately one-half a period of said desired harmonic.

24. The WLAN device of claim 1, wherein said transmitter receives an information signal, wherein said transmitter comprises:

a modulator that receives said information signal and outputs a modulated signal;

a buffer/inverter, for receiving said modulated signal and generating an inverted modulated signal;

a first controlled switch, coupled to an output of said buffer/inverter, said first controlled switch shunting said modulated signal to ground according to a first control signal, and resulting in a first harmonically rich signal;

a second controlled switch coupled to a second output of said buffer/inverter, said second controlled switch shunting said inverted modulated signal to ground according to a second control signal, and resulting in a second harmonically rich signal;

a combiner, coupled to an output of said first controlled switch and an output of said second controlled switch, said combiner combining said first harmonically rich signal and said second harmonically rich signal, resulting in a third harmonically rich signal;

wherein said first control signal and said second control signal comprise pulses having a pulse width T_A that operate to improve energy transfer to a desired harmonic in said third harmonically rich signal;

wherein said first control signal and said second control signal are phase shifted with respect to each other; and

wherein said output RF signal comprises said third harmonically rich signal.

25. The WLAN device of claim 24, wherein:

said first controlled switch comprises a first field effect transistor (FET), a gate of said first FET coupled to said first control signal, a source of said first FET receiving said modulated signal and outputting said first harmonically rich signal, and a drain of said first FET coupled to ground; and

said second controlled switch comprises a second field effect transistor (FET), a gate of said second FET coupled to said second control signal, a source of said second FET receiving said inverted modulated signal and outputting said second harmonically rich signal, and a drain of said second FET coupled to ground.

26. The WLAN device of claim 25, wherein said first FET and said second FET alternately shunt said modulated signal and said inverted modulated signal to ground, respectively, according to said first control signal and said second control signal, to generate said harmonically rich signals.

27. The WLAN device of claim 26, wherein said pulse width T_A is approximately one-half of a period associated with said desired harmonic in said third harmonically rich signal.

28. The WLAN device of claim 1, wherein said physical layer comprises a direct sequence spread spectrum (DSSS) physical layer, wherein said input RF signal comprises a differential binary phase shift keying modulated signal or a differential quadrature phase shift keying modulated signal.

29. The WLAN device of claim 28, wherein said receiver comprises a differential phase shift keying modulation receiver, wherein said differential phase shift keying modulation receiver receives said input RF signal and outputs a down-converted demodulated signal, and wherein said physical medium dependent sublayer further comprises:

a de-spread correlator that receives said down-converted demodulated signal and receives an 11-bit Barker word, wherein said de-spread correlator outputs a de-spread signal; and

a de-scrambler that receives said de-spread signal and outputs at least a portion of at least one PPDU frame.

30. The WLAN device of claim 28, wherein said receiver comprises a differential phase shift keying modulation receiver, and wherein said physical medium dependent sublayer further comprises:

a de-spread correlator that receives said input RF signal and receives an 11-bit Barker word, wherein said de-spread correlator outputs a de-spread signal; and

a de-scrambler;

wherein said differential phase shift keying modulation receiver receives said de-spread signal and outputs a down-converted demodulated signal; and

wherein said de-scrambler receives said down-converted demodulated signal and outputs at least a portion of at least one PPDU frame.

31. The WLAN device of claim 28, wherein said receiver comprises a combined differential phase shift keying modulation receiver and de-spread correlator, wherein said receiver/de-spreader receives said input RF signal and receives an 11-bit Barker word, wherein said receiver/de-spreader outputs a demodulated/de-spread signal, wherein said physical medium dependent sublayer further comprises:

a de-scrambler that receives said demodulated/de-spread signal and outputs at least a portion of at least one PPDU frame.

32. The WLAN device of claim 1, wherein said physical layer comprises a direct sequence spread spectrum (DSSS) physical layer, wherein said output RF signal comprises a differential binary phase shift keying modulated signal or a differential quadrature phase shift keying modulated signal.

33. The WLAN device of claim 32, wherein said transmitter comprises a differential phase shift keying modulation transmitter, and wherein said physical medium dependent sublayer further comprises:

a scrambler that receives at least a portion of at least one PPDU frame and outputs a scrambled at least one PPDU frame portion;

a modulo-2 adder that receives said scrambled at least one PPDU frame portion, wherein said modulo-2 adder receives an 11-bit Barker word, and wherein said scrambler outputs a spread signal; and

a transmit mask filter that receives said spread signal and outputs a filtered signal; and

wherein said differential phase shift keying modulation transmitter receives said filtered signal, wherein said differential phase shift keying modulation transmitter transmits said output RF signal.

34. The WLAN device of claim 1, wherein said physical layer comprises a frequency hopping spread spectrum physical layer, wherein said input RF signal comprises a 2-level or 4-level Gaussian frequency shift keying modulated signal.

35. The WLAN device of claim 34, wherein said receiver comprises a Gaussian frequency shift keying modulation receiver, wherein said Gaussian frequency shift keying modulation receiver receives said input RF signal, wherein said Gaussian frequency shift keying modulation receiver outputs a demodulated signal, wherein said physical medium dependent sublayer further comprises:

a data de-whitener that receives said demodulated signal and outputs at least a portion of at least one PPDU frame.

36. The WLAN device of claim 1, wherein said physical layer comprises a frequency hopping spread spectrum physical layer, wherein said output RF signal comprises a 2-level or 4-level Gaussian frequency shift keying modulated signal.

37. The WLAN device of claim 36, wherein said transmitter comprises a Gaussian frequency shift keying modulation transmitter, wherein said physical medium dependent sublayer further comprises:

a data whitener that receives at least a portion of at least one PPDU frame and outputs a whitened at least one PPDU frame portion; and

a transmit Gaussian shaping filter that receives said at least one whitened at least one PPDU frame portion and outputs a filtered signal;

wherein said Gaussian frequency shift keying modulation transmitter receives said filtered signal, wherein said Gaussian frequency shift keying modulation transmitter transmits said output RF signal.

38. The WLAN device of claim 37, wherein said physical medium dependent sublayer further comprises:

a symbol mapping module that maps said whitened at least one PPDU frame portion.

39. The WLAN device of claim 38, wherein said physical layer comprises an orthogonal frequency division multiplexing physical layer, wherein said input RF signal comprises a binary phase shift keying modulated signal, a quadrature phase shift keying modulated signal, a 16-QAM modulated signal, or a 64-QAM modulated signal.

40. The WLAN device of claim 1, wherein said receiver comprises a phase shift keying/quadrature amplitude modulation (PSK/QAM) receiver, wherein said PSK/QAM modulation receiver receives said RF input signal and outputs a demodulated signal, wherein said physical medium dependent sublayer further comprises:

a fast Fourier transform (FFT) module that receives said demodulated signal and outputs a FFT module output signal;

a bit de-interleaving and de-mapping module that receives said FFT module output signal and outputs an encoded at least one data frame; and

a convolutional code decoder that receives said encoded at least one data frame and outputs at least a portion of at least one PPDU frame.

41. The WLAN device of claim 40, wherein said physical medium dependent sublayer further comprises:

a symbol shaping module that shapes said encoded signal.

42. The WLAN device of claim 1, wherein said physical layer comprises an orthogonal frequency division multiplexing physical layer, wherein said output RF signal comprises a binary phase shift keying modulated signal, a quadrature phase shift keying modulated signal, a 16-QAM modulated signal, or a 64-QAM modulated signal.

43. The WLAN device of claim 42, wherein said transmitter comprises a phase shift keying/quadrature amplitude modulation (PSK/QAM) transmitter, wherein said physical medium dependent sublayer further comprises:

a convolutional encoder that receives at least a portion of at least a PPDU frame and outputs an encoded at least one PPDU frame portion;

a bit interleaving and mapping module that receives said encoded at least one PPDU frame portion and outputs at least one bit interleaved and mapped signal; and

an inverse fast Fourier transform (IFFT) module that receives said at least one bit interleaved and mapped signal and outputs an IFFT module output signal; and

wherein said PSK/QAM modulation transmitter receives said IFFT module output signal and transmits said output RF signal.

44. The WLAN device of claim 1, wherein said physical layer comprises a high rate direct sequence spread spectrum physical layer, wherein said transmitter comprises a phase shift keying (PSK) modulation transmitter, wherein said output RF signal comprises a packet binary convolutional coding modulated signal, wherein said physical medium dependent sublayer further comprises:

a scrambler that receives at least a portion of at least one PPDU frame and outputs a scrambled at least one PPDU frame portion;

a binary convolutional code encoder that receives said scrambled at least one PPDU frame portion and outputs an encoded signal;

a cover code sequence generator that receives a 16-bit cover code seed and outputs a cover sequence; and

a PSK cover code map module that receives said cover sequence and said encoded signal, and outputs a mapped signal; and

wherein said PSK modulation transmitter receives said mapped signal, wherein said PSK modulation transmitter transmits said output RF signal.

45. The WLAN device of claim 1, wherein said physical layer comprises a high rate direct sequence spread spectrum physical layer, wherein said transmitter comprises a differential quadrature phase shift keying (DQPSK) modulation transmitter, wherein said output RF signal comprises a complementary code keying modulated signal, wherein said physical medium dependent sublayer further comprises:

a scrambler that receives at least one data frame and outputs a scrambled at least one data frame;

a data multiplexer that receives said scrambled at least one data frame, wherein said data multiplexer outputs a first multiplexed data portion and a second multiplexed data portion; and

a complex code selector module that receives said first multiplexed data portion and outputs a selected code; and

wherein said DQPSK modulation transmitter receives said selected code and said second multiplexed data portion, wherein said DQPSK modulation transmitter transmits said output RF signal.

46. The WLAN device of claim 1, wherein said MAC and said physical layer are comprised by a network adaptor or a network interface card.

47. The WLAN device of claim 1, wherein said transmitter comprises a UFU module, wherein said UFU module comprises a first universal frequency translation (UFT) module.

48. The WLAN device of claim 47, wherein said UFT module is configured to amplitude modulate, frequency modulate, or phase modulate a carrier signal with an information signal.

49. The WLAN device of claim 48, wherein said transmitter further comprises a second UFT module, wherein said first and second UFT modules are configured to modulate and up-convert information signals to in-phase and quadrature-phase channels.

50. The WLAN device of claim 49, wherein said information signals are modulated and up-converted according to quadrature amplitude modulation, differential quadrature phase shift keying, quadrature phase shift keying, complementary code keying, or packet binary convolutional coding modulation schemes.

51. The WLAN device of claim 1, wherein said UFD module comprises a universal frequency translation (UFT) module.

52. The WLAN device of claim 51, wherein said input RF signal is an amplitude modulated, frequency modulated, or phase modulated signal, wherein said UFT module is configured to demodulate said input RF signal to an information signal.

53. The WLAN device of claim 52, wherein said receiver further comprises a second UFT module, wherein said first and second UFT modules are configured to down-convert and demodulate in-phase and quadrature-phase components of a received signal.

54. The WLAN device of claim 53, wherein said received signal comprises a quadrature amplitude modulated, differential quadrature phase shift keying modulated, quadrature phase shift keying modulated, complementary code keying, or packet binary convolutional coding modulated signal.

55. The WLAN device of claim 1, wherein said UFD module is tuned for at least one frequency substantially equal to one of or between 2.402 Giga Hertz and 2.495 Giga Hertz.

56. The WLAN device of claim 1, wherein the device is an access point, computer, personal data assistant (PDA), automatic identification data collection device, telephone, network device, or combination thereof.

57. The WLAN device of claim 22, wherein said first modulator and said second modulator amplitude modulate, frequency modulate, or phase modulate a carrier signal frequency with said I baseband signal and said Q baseband signal, respectively.

58. The WLAN device of claim 22, wherein said first modulator and said second modulator each comprise a digital-to-analog (D/A) converter.

59 ~~60.~~ The WLAN device of claim 24, wherein said modulator amplitude modulates, frequency modulates, or phase modulates a carrier signal frequency with said information signal.

60 ~~61.~~ The WLAN device of claim 24, wherein said modulator comprises a digital-to-analog (D/A) converter.